

Serial No. 10/066,533

Docket No. UVD 0276 PA/40815.372

AMENDMENTS TO THE CLAIMS

The following listing of claims will replace all prior versions, and listings, of claims in the present application:

1. (Currently Amended) A process for recovery of hexavalent chromium from a stream comprising:
 - providing the stream containing hexavalent chromium;
 - reacting a soluble ~~non-toxic~~ low toxicity precipitating reagent with the hexavalent chromium to form an insoluble precipitating reagent-chromate precipitate;
 - reacting the insoluble precipitating reagent-chromate precipitate with an acidic solution to form an insoluble precipitating reagent precipitate and a soluble hexavalent chromium compound; and
 - recovering the soluble hexavalent chromium compound.
2. (Currently Amended) The process of claim 1 wherein the soluble ~~non-toxic~~ low toxicity precipitating reagent is selected from bismuth compounds; lanthanide compounds; aluminum compounds; titanium compounds, trivalent chromium compounds; organic compounds containing a group selected from nitronium, phosphonium, sulfonium, stibonium, iodonium, pyrylium, or combinations thereof; or combinations thereof.
3. (Original) The process of claim 1 wherein the acidic solution is selected from sulfuric acid, hydrochloric acid, hydrofluoric acid, boric acid, phosphoric acid, pyrophosphoric acid, phosphomolybdic acid, phosphotungstic acid, silicomolybdic acid, silicotungstic acid, or combinations thereof.

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4. (Original) The process of claim 1 wherein the acidic solution is selected from acidic oxalates, malonates, succinates, maleates, fumarates, malates, tartrates, salicylates, or combinations thereof.
5. (Original) The process of claim 1 wherein the insoluble precipitating reagent-chromate precipitate has a solubility of less than 1×10^{-2} M Cr^{+6} .
6. (Original) The process of claim 5 wherein the insoluble precipitating reagent-chromate precipitate has a solubility of less than 5×10^{-3} M Cr^{+6} .
7. (Original) The process of claim 1 wherein the process is carried out at temperatures in the range of from about 5°C to about 100°C.
8. (Original) The process of claim 1 wherein recovering the soluble hexavalent chromium compound comprises obtaining a solid using a process selected from evaporation, freeze drying, or salting out.
9. (Currently Amended) The process of claim 1 further comprising reacting the insoluble precipitating reagent precipitate with a solubilizing reagent to form the soluble ~~non-toxic~~ low toxicity precipitating reagent.
10. (Original) The process of claim 9 wherein the solubilizing reagent is selected from nitric acid, perchloric acid, sulfuric acid, hydrochloric acid, acetic acid, propionic acid, lactic acid, citric acid, or combinations thereof.

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11. (Currently Amended) The process of claim 9 further comprising recovering the soluble ~~non-toxic~~ low toxicity precipitating reagent using a process selected from evaporation, freeze-drying, or salting out.

12. (Currently Amended) The process of claim 1 wherein the ~~non-toxic~~ low toxicity precipitating reagent is an organic ~~compounds~~ compound containing a group selected from nitronium or phosphonium.

13. (Currently Amended) A process for recovery of hexavalent chromium from a stream comprising:

providing the stream containing hexavalent chromium;

reacting a soluble ~~non-toxic~~ low toxicity precipitating reagent with the hexavalent chromium to form an insoluble precipitating reagent-chromate precipitate; and

recovering the insoluble precipitating reagent-chromate precipitate.

14. (Currently Amended) The process of claim 13 wherein the soluble ~~non-toxic~~ low toxicity precipitating reagent is selected from bismuth compounds; lanthanide compounds; aluminum compounds; titanium compounds, trivalent chromium compounds; organic compounds containing a group selected from nitronium, phosphonium, sulfonium, stibonium, iodonium, pyrylium, or combinations thereof; or combinations thereof.

15. (Original) The process of claim 13 wherein the insoluble precipitating reagent-chromate precipitate has a solubility of less than 1×10^{-2} M Cr^{+6} .

16. (Original) The process of claim 15 wherein the insoluble precipitating reagent-chromate precipitate has a solubility of less than 5×10^{-3} M Cr^{+6} .

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17. (Original) The process of claim 13 wherein the process is carried out at temperatures in the range of from about 5°C to about 100°C.

18. (Original) The process of claim 17 further comprising:

reacting the insoluble precipitating reagent-chromate precipitate with an acidic solution to form an insoluble precipitating reagent precipitate and a soluble hexavalent chromium compound; and

recovering the soluble hexavalent chromium compound.

19. (Original) The process of claim 18 wherein the acidic solution is selected from sulfuric acid, hydrochloric acid, hydrofluoric acid, boric acid, phosphoric acid, pyrophosphoric acid, phosphomolybdic acid, phosphotungstic acid, silicomolybdic acid, silicotungstic acid, or combinations thereof.

20. (Original) The process of claim 18 wherein the acidic solution is selected from acidic oxalates, malonates, succinates, maleates, fumarates, malates, tartrates, salicylates, or combinations thereof.

21. (Original) The process of claim 18 wherein recovering the soluble hexavalent chromium compound comprises obtaining a solid using a process selected from evaporation, freeze drying, or salting out.

22. (Currently Amended) The process of claim 18 further comprising reacting the insoluble precipitating reagent precipitate with a solubilizing reagent to form the soluble ~~non-toxic~~ low toxicity precipitating reagent.

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23. (Original) The process of claim 22 wherein the solubilizing reagent is selected from nitric acid, perchloric acid, sulfuric acid, hydrochloric acid, acetic acid, propionic acid, lactic acid, citric acid, or combinations thereof.

24. (Currently Amended) The process of claim 22 further comprising recovering the soluble ~~non-toxic~~ low toxicity precipitating reagent using a process selected from evaporation, freeze-drying, or salting out.

25. (Currently Amended) The process of claim 13 wherein the ~~non-toxic~~ low toxicity precipitating reagent is an organic ~~compounds~~ compound having a group selected from nitronium or phosphonium.

26. (Currently Amended) A process for recovery of hexavalent chromium from a stream comprising:

providing the stream containing hexavalent chromium;

reacting a soluble ~~non-toxic~~ low toxicity precipitating reagent with the hexavalent chromium to form an insoluble precipitating reagent-chromate precipitate, the soluble ~~non-toxic~~ low toxicity precipitating reagent selected from bismuth compounds; lanthanide compounds; aluminum compounds; titanium compounds, trivalent chromium compounds; organic compounds containing a group selected from nitronium, phosphonium, sulfonium, stibonium, iodonium, pyrylium, or combinations thereof; or combinations thereof;

reacting the insoluble precipitating reagent-chromate precipitate with an acidic solution to form an insoluble precipitating reagent precipitate and a soluble hexavalent chromium compound;

recovering the soluble hexavalent chromium compound; and

reacting the insoluble precipitating reagent precipitate with a solubilizing reagent to form the soluble ~~non-toxic~~ low toxicity precipitating reagent.

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27. (Original) The process of claim 26 wherein the acidic solution is selected from sulfuric acid, hydrochloric acid, hydrofluoric acid, boric acid, phosphoric acid, pyrophosphoric acid, phosphomolybdic acid, phosphotungstic acid, silicomolybdic acid, silicotungstic acid, or combinations thereof.

28. (Original) The process of claim 26 wherein the acidic solution is selected from acidic oxalates, malonates, succinates, maleates, fumarates, malates, tartrates, salicylates, or combinations thereof.

29. (Original) The process of claim 26 wherein the insoluble precipitating reagent-chromate precipitate has a solubility of less than 1×10^{-2} M Cr^{+6} .

30. (Original) The process of claim 29 wherein the insoluble precipitating reagent-chromate precipitate has a solubility of less than 5×10^{-3} M Cr^{+6} .

31. (Original) The process of claim 26 wherein the solubilizing reagent is selected from nitric acid, perchloric acid, sulfuric acid, hydrochloric acid, acetic acid, propionic acid, lactic acid, citric acid, or combinations thereof.

32. (Original) The process of claim 26 wherein the process is carried out at temperatures in the range of from about 5°C to about 100°C.

33. (Original) The process of claim 26 wherein recovering the soluble hexavalent chromium compound comprises obtaining a solid using a process selected from evaporation, freeze drying, or salting out.

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34. (Currently Amended) The process of claim 26 further comprising recovering the soluble ~~non-toxic~~ low toxicity precipitating reagent using a process selected from evaporation, freeze-drying, or salting out.

35. (Currently Amended) The process of claim 26 wherein the ~~non-toxic~~ low toxicity precipitating reagent is an organic compound having a group selected from nitronium or phosphonium.

36. (Original) The method of claim 9 further comprising heating the insoluble precipitating reagent precipitate to a temperature of less than about 250°C to convert the insoluble precipitating reagent precipitate to an oxide or hydroxide before reacting the insoluble precipitating reagent precipitate with the solubilizing reagent.

37. (Original) The method of claim 22 further comprising heating the insoluble precipitating reagent precipitate to a temperature of less than about 250°C to convert the insoluble precipitating reagent precipitate to an oxide or hydroxide before reacting the insoluble precipitating reagent precipitate with the solubilizing reagent.

38. (Original) The method of claim 26 further comprising heating the insoluble precipitating reagent precipitate to a temperature of less than about 250°C to convert the insoluble precipitating reagent precipitate to an oxide or hydroxide before reacting the insoluble precipitating reagent precipitate with the solubilizing reagent.

39. (Original) The method of claim 1 wherein the stream containing hexavalent chromium is selected from chrome plating process waste streams, anodizing process waste streams, conversion coating process waste streams, phosphating process waste streams, paint process waste streams, paint extract process waste streams, polymerization process waste streams, leather

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tanning process waste streams, wood preservative waste streams, fungicide waste streams, pesticide waste streams, landfill waste streams, contaminated site waste streams, or combinations thereof.

40. (Original) The method of claim 13 wherein the stream containing hexavalent chromium is selected from chrome plating process waste streams, anodizing process waste streams, conversion coating process waste streams, phosphating process waste streams, paint process waste streams, paint extract process waste streams, polymerization process waste streams, leather tanning process waste streams, wood preservative waste streams, fungicide waste streams, pesticide waste streams, landfill waste streams, contaminated site waste streams, or combinations thereof.

41. (Original) The method of claim 26 wherein the stream containing hexavalent chromium is selected from chrome plating process waste streams, anodizing process waste streams, conversion coating process waste streams, phosphating process waste streams, paint process waste streams, paint extract process waste streams, polymerization process waste streams, leather tanning process waste streams, wood preservative waste streams, fungicide waste streams, pesticide waste streams, landfill waste streams, contaminated site waste streams, or combinations thereof.

42. (Original) The method of claim 1 wherein the stream containing hexavalent chromium is an aqueous stream.

43. (Original) The method of claim 13 wherein the stream containing hexavalent chromium is an aqueous stream.

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44. (Original) The method of claim 26 wherein the stream containing hexavalent chromium is an aqueous stream.